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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/826,665	04/16/2004	Chang Seo Park	61472-0308425	9608

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EXAMINER	
HARRISON, MONICA D	
ART UNIT	**PAPER NUMBER**
2813	

DATE MAILED: 03/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/826,665	PARK ET AL.	
	Examiner	Art Unit	
	Monica D. Harrison	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 April 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 4-16-04
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Wu (5,989,950).

1. Regarding claim 1, Wu discloses a method of fabricating a CMOS device comprising the steps of: (a) forming a gate dielectric on a semiconductor substrate that can be sectioned into a p-well region for forming an NMOSFET and a n-well region for creating PMOSFET (Figure 1, reference 6); (b) forming a buffer layer material over the gate dielectric (Figure 1, reference 8); (c) depositing a first metal on the buffer layer (Figure 6, reference 16); (d) selectively etching the first metal with a first etchant so that the buffer layer is exposed on one of said p-well and n-well regions (Figure 7, reference 22); (e) depositing a second metal on both the exposed buffer layer and the remaining first metal (Figure 7, reference 20); (f) removing said first metal and said second metal and said buffer layer in selected areas so as to form a PMOSFET gate electrode and an NMOSFET gate electrode of said CMOS device (Figure 10); and (g) annealing remaining portions of said first metal and said second metal and said buffer layer to consume said portions of said buffer layer by reacting with said first metal and said second metal to form first and second conductive alloys with first and second work functions respectively (column 5, lines 7-39).

2. Regarding claim 2, Wu discloses wherein said buffer layer material is selected to have é resistance to said first etchant for protecting said gate dielectric from said first etchant (Figure 1, reference 8).

3. Regarding claim 11, Wu discloses a method of determining a work function of a metal gate electrode comprising: determining a desired work function of a metal gate electrode including (a) depositing a buffer layer material (Figure 1, reference 8) on a gate dielectric (Figure 1, reference 6); (b) depositing a metal on said buffer layer material (Figure 6, reference 16); and (c) annealing said buffer layer and said metal to cause said buffer material and said metal to react and form an alloy having the desired work function (column 2, lines 37-54).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3-7, 9, 10, 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu (5,989,950) in view of Lim et al (6,265,302 B1).

4. Wu discloses all above claimed subject matter except the buffer layer including aluminum and nitrogen (claims 3 and 12), the thickness of the aluminum and nitrogen layer (claim 4), sulfuric acid and hydrogen peroxide (claim 5), hydrofluoric acid (claim 6), annealing temperature in excess of 400C (claim 7), PVD, CVD or ALD (claim 9), and the aluminum and nitrogen is selected to achieve a desired work function (claims 10 and 13).

Lim et al discloses aluminum and nitrogen (column 2, lines 46-60), the thickness of the aluminum and nitrogen layer (column 6, lines 14-21), sulfuric acid and hydrogen peroxide (column 6, lines 50-59), hydrofluoric acid (column 6, lines 9-13), annealing temperature in excess of 400C (column 7, lines 9-39), PVD, CVD or ALD (column 6, lines 14-21), and the aluminum and nitrogen is selected to achieve a desired work function (column 2, lines 37-54).

It is obvious, at the time the invention was made, for one having ordinary skill in the art, to modify Wu, with the teachings of Lim et al, for the purpose of improving a new process for fabricating MOSFET in STI structures.

Claims 8, 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu (5,989,950) and Lim et al (6,265,302 B1) further in view of Huotari et al (US 2004/0106261 A1).

5. Wu and Lim et al disclose all above claimed subject matter except the first metal being hafnium and the second metal being tantalum (claims 8 and 14) and having electronegativity (claim 15).

Huotari et al discloses the first metal being hafnium and the second metal being tantalum (pg.5, paragraph 0054; pg.6, paragraph 0061) and having electronegativity (pg.3, paragraph 0035).

It is obvious, at the time the invention was made, for one having ordinary skill in the art, to modify Wu and Lim et al with the teachings of Huotari et al, for the purpose of forming a desired work function of a gate electrode in a gate stack for a semiconductor device.

Claims 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huotari et al (US 2004/0106261 A1).

6. Regarding claim 16, Huotari et al discloses a metal gate for CMOS applications, wherein the contact area between said metal gate and adjacent metal gate dielectric is comprised of an alloy formed from AlN_x and a metal whose electronegativity is less than 1.4 (pg.3, paragraph 0035). However, Huotari et al does not disclose the specified range of the electronegativity.

It is obvious, at the time the invention was made, for on having ordinary skill in the art, to provide a metal gate whose electronegativity is less than 1.4, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the "optimum range" involves only routine skill in the art. ***In re Aller***, 105 USPQ 233 (1955).

7. Regarding claim 17, Huotari et al discloses where the metal is Hf, and the alloy has a work function of approximately 4.4eV, appropriate for NMOS (pg, 3, paragraph 0035).

8. Regarding claim 18, Huotari et al discloses where the metal is Ta, and the alloy has a work function of approximately 4.9eV, appropriate for PMOS (pg.5, paragraph 0053).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica D. Harrison whose telephone number is 571-272-1959. The examiner can normally be reached on M-F 7:00am-3:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Monica D. Harrison
AU 2813

mdh
March 17, 2006

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